

2 May 2001

From: EV22WJ (Winoma Johnson)
To: MLAJC (John Chamberlayne)

Subj: CASY MONITORING WELL REPLACEMENT

1. The enclosed document provides a Monitoring Well Replacement Plan for wells that are located in the Camp Allen area within 500 feet of the I-564 Connector Project. Plan identifies six wells with an estimated removal and replacement cost of \$82,301.
2. The preferred option for this work is to utilize Navy contractors under an existing Installation Restoration contract. This will ensure that the Navy maintains all documentation on the well locations and continues compliance with existing monitoring requirements.
3. If you have any questions, contact Winoma Johnson at 322-4587.

A handwritten signature in cursive script, appearing to read "Winoma Johnson", with a long horizontal flourish extending to the right.

Replacement of Monitoring Wells in Camp Allen Area of Naval Station, Norfolk

PREPARED FOR:

Ms. Winoma Johnson/LANTDIV, Code EV22WJ

PREPARED BY:

John Tomik/CH2M HILL

DATE:

April 23, 2001

This memorandum provides guidance for the replacement of monitoring wells that require removal due to the construction of the Interstate 564 (I-564) Connector and the proposed ballfields in the Camp Allen Area of Naval Station, Norfolk.

Project Background

An extension of I-564 (I-564 Connector) is proposed for construction through the Camp Allen Area of Naval Station, Norfolk. The design of the I-564 Connector is scheduled to be completed in February, 2002. Construction is scheduled to be initiated in May 2003.

The attached Figure 1 shows the proposed alignment of the I-564 Connector, the proposed ballfield locations and the groundwater monitoring wells in the vicinity of the Camp Allen Landfill. The shaded area delineates the extent of the I-564 right-of-way. As shown on Figure 1 the monitoring wells likely to be impacted by the I-564 construction activities are: NBS01-A-MW17A, NBS01-A-MW17B, NBS01-A-MW30A, NBS01-A-MW30B, NBS01-A-MW32B, NBS01-A-MW34A. The wells likely to be impacted by the ballfield construction are: NBS01-A-GW3, NBS01-B-GW5, NBS01-B-MW5B, NBS01-B-MW7, NBS01-B-MW19A, and NBS01-B-MW19B. These monitoring wells are sampled as part of the Camp Allen Landfill Long Term Monitoring Program. The specifications of the monitoring wells are summarized in Table 1.

Table 1

Well Number	Well Diameter (inches)	Well Depth From G.S.	Top Of Screen From G.S.	Bottom Of Screen From G.S.	
NBS01-A-GW3	2		24	4	24
NBS01-A-MW17A	2		12	2	12
NBS01-A-MW17B	2		66	56	66
NBS01-A-MW30A	2		12	2	12
NBS01-A-MW30B	2		65	55	66
NBS01-A-MW32B	2		65	55	65
NBS01-A-MW34A	2		16	6	16
NBS01-B-GW5	2		24	4	24
NBS01-B-MW5B	2		60	50	60
NBS01-B-MW7	2		30	12	22
NBS01-B-MW19A	2		15	5	15
NBS01-B-MW19B	2		67	25	45

Well Abandonment Procedures

The twelve-groundwater monitoring wells listed in Table 1 will be abandoned by pumping a cement/bentonite grout into the well screen and riser. The grout will be pumped through a tremie pipe that will extend to the bottom of the well. The tremie pipe will be raised as the grout fills the well. The grout mixture will consist of one 94 lbs. bag of cement and 2-3 lbs. of bentonite per 6 gallons of water.

Following the well grouting, the PVC and steel protective well casings will be cut off at a depth of two feet below grade. In addition the concrete pads and protective posts will be removed. The scrap well casings will be disposed of by the contractor off-site as construction debris.

Well Installation Procedures

The proposed replacement well locations for the I-564 Connector are shown on Figure 2. The proposed replacement wells for the ballfield are to be installed to the nearest point from the original location, outside the affected construction area. Therefore, the replacement locations for the wells in the ballfield area are not shown in Figure 2. Standard Operating Procedures for soil boring drilling and logging, general well installation, shallow well installation and surface cased well installation are provided in Attachment A. The monitoring wells are to be constructed of two-inch diameter PVC casing and well screen within a 6-inch diameter steel protective casing. The depth of the wells should be equivalent to the depths of the wells that are to be replaced.

Investigation Derived Waste

All soil and drilling mud generated from boreholes will have to be containerized in 55-gallon drums. The drums will be properly labeled and transported to the Camp Allen Treatment Plant. A single composite soil sample of all the drums will be collected and analyzed for RCRA hazardous waste characteristics to determine the disposition of the soil cuttings.

All water generated from well development and decontamination will be contained in 55-gallon drums. These drums will be transported to the Camp Allen Treatment Plant where the water will be treated.

Health and Safety

The Health and Safety Plan included as Attachment B documents the site-specific procedures and methodologies related to maintaining personal health and safety during the abandonment and replacement of the monitoring wells.

Cost Estimate

The estimated cost to complete the well abandonment and replacement is \$82,301, a detailed estimate is included as Attachment C.

General Guidance for Monitoring Well

Installation

I. Purpose

To provide site personnel with a review of the well installation procedures that will be performed. These procedures are to be considered general guidelines only and are in no way intended to supplement or replace the contractual specifications in the driller's subcontract.

II. Scope

Bedrock well installations and shallow unconsolidated well installations are planned.

III. Equipment and Materials

IV. Procedures and Guidelines

1. Wells will be installed in accordance with standard EPA procedures. Note that USEPA Region III requires any well penetrating a confining layer to be double cased.
2. The threaded connections will be water-tight.
3. Shallow well screens will be constructed of 0.010 slot Schedule 40 PVC and will be 5 to 10 feet in length depending on saturated thickness of unconsolidated sediments. The exact length will be determined by the field team supervisor.
4. Wells will be surrounded by three concrete-filled, 4-inch diameter guard posts.
5. A record of the finished well construction will be compiled.
6. All soils and liquids generated during well installations will be drummed for proper disposal.

Shallow Unconsolidated Well Installation

- Monitoring wells in unconsolidated materials will be installed in at least 6-inch-diameter boreholes to accommodate well completion materials in designated locations.
- Unconsolidated monitoring wells will be constructed of 2-inch-diameter, factory manufactured, flush-jointed, schedule 40 PVC screen with threaded bottom plug and riser.
- Screens will be filter packed with a proper sized and graded, thoroughly washed, sound, durable, well-rounded basalt or siliceous sand.
- The filter pack will extend from 1 to 2 feet below the base to 2 feet above the top of the screen; filter pack will be allowed to settle before final measurement is taken.
- Annular well seals will consist of 2 feet of pelletized bentonite clay and placed above the filter pack.
- The top of the annular seal will be measured after the pellets have been allowed to settle and before the grout is applied.
- The annular space above the bentonite seal will be filled to grade with a bentonite-cement slurry grout mixture.
- The grout mixture consists of 94 lbs of cement (1 bag) per 6 gallons of water and 2 to 3 lbs of powdered bentonite per bag of cement to reduce shrinkage.
- The grout mix will be carefully applied to avoid disturbing the bentonite seal; the method of grout placement must force grout from the bottom of the space to be grouted to the surface.
- After allowing the grout to settle overnight, additional grout will be added to maintain grade.
- A protective steel casing equipped with keyed alike locking caps will be grouted in place for each new well; the casing will extend at least 2 feet above grade and painted a bright color.

Well Development

- New monitoring wells will be developed after the well has been completely installed and the grout has hardened (at least 24 hours)
- The well will be developed by surging and pumping.
- Equipment placed in the well will be decontaminated before use.
- Development will include surging the well by abruptly stopping flow and allowing water in the well column to fall back into the well.

- Pipes and pumps must not be fitted with foot valves or other devices that might inhibit the return flow of water to the well.
- Surging should continue throughout the development process.
- The air lift method will be used to pump materials out of the well. The air compressor will be fitted with filters to remove all oil and the air lift hose used will be made of inert materials.
- Well development will continue until the water produced is free of turbidity, sand, and silt.
- Development water will be considered hazardous and placed in sealed 55-gallon U.S. DOT approved steel drums supplied by CH2M HILL. CH2M HILL will label and date the drums, and transport the drums to an EPA designated site for storage.

V. Attachments

None.

VI. Key Check and Items

STANDARD OPERATING PROCEDURE

Installation of Shallow Monitoring Wells

I. Purpose and Scope

The purpose of this guideline is to describe methods for drilling and installation of shallow monitoring wells and piezometers in unconsolidated or poorly consolidated materials. Methods for drilling and installing bedrock monitoring wells are presented in SOP Installation of Bedrock Monitoring Wells.

II. Equipment and Materials

Drilling

- Drilling rig
- Hollow-stem augers

Well Riser/Screen

- Polyvinyl chloride (PVC), Schedule 40, minimum 2-inch ID, flush-threaded riser; alternatively, stainless steel riser
- PVC, Schedule 40, minimum 2-inch ID, flush-threaded, factory slotted screen; alternatively, stainless steel screen.

Bottom Cap

- PVC, threaded to match the well screen; alternatively, stainless steel
- Centering Guides (if used)

Well Cap

- Above-grade well completion: PVC, threaded or push-on type, vented
- Flush-mount well completion: PVC, locking, leak-proof seal
- Stainless steel to be used as appropriate

Sand

- Clean silica sand, provided in factory-sealed bags, well-rounded, containing no organic material, anhydrite, gypsum, mica, or calcareous material; primary (coarse) filter pack, and secondary (fine) filter pack. Grain size determined based on sediments observed during drilling.

Bentonite

- Pure, additive-free bentonite pellets
- Pure, additive-free powdered bentonite

- Coated bentonite pellets; coating must biodegrade within 7 days
- Cement-Bentonite Grout: proportion of 6 to 8 gallons of water per 94-pound bag of Portland cement; 3 to 6 pounds of bentonite added per bag of cement to reduce shrinkage

Protective Casing

- Above-grade well completion: 6-inch minimum ID steel pipe with locking cover, diameter at least 2 inches greater than the well casing, painted with epoxy paint for rust protection; heavy duty lock; protective posts if appropriate
- Flush-mount well completion: Morrison 9-inch or 12-inch 519 manhole cover, or equivalent; rubber seal to prevent leakage; locking cover inside of road box

Well Development

- Double surge block with solid bottom, top open, separated by 2 feet of slotted pipe
- Well-development pump, and associated equipment
- Containers (e.g., 55 gallon drums) for water produced from well.

III. Procedures and Guidelines

A. Drilling Method

Continuous-flight hollow-stem augers with a minimum 6-inch inside diameter (ID) will be used to drill shallow monitoring well boreholes. Split-spoon samples will be collected at selected intervals for chemical analysis and/or lithologic classification. Soil sampling procedures are detailed in SOP Shallow Soil Sampling.

The use of water to assist in hollow-stem auger drilling for monitoring well installation will be avoided, unless required for such conditions as running sands.

Hollow-stem augers, rods, split-spoon samplers, and other downhole drilling tools will be properly decontaminated prior to the initiation of drilling activities and between each borehole location. Split-spoon samplers and other downhole soil sampling equipment will also be properly decontaminated before and after each use. SOP Decon details proper decontamination procedures.

Drill cuttings and decontamination fluids generated during well drilling activities will be contained according to the procedures detailed in the Field Sampling Plan.

B. Monitoring Well Installation

Shallow monitoring wells will be constructed inside the hollow-stem augers, once the borehole has been advanced to the desired depth. If the borehole

has been drilled to a depth greater than that at which the well is to be set, the borehole will be backfilled with bentonite pellets or a bentonite-cement slurry to a depth approximately 1 foot below the intended well depth. Approximately 1 foot of clean sand will be placed on top of the bentonite to return the borehole to the proper depth for well installation.

The appropriate lengths of well screen, nominally 10 feet (with bottom cap), and casing will be joined watertight and lowered inside the augers to the bottom of the borehole. Centering guides, if used, will be placed at the bottom of the screen and above the interval in which the bentonite seal is placed.

Selection of the filter pack and well screen intervals for the shallow monitoring wells shall be made in the field. Based on lithologic samples previously obtained at the site, and comparison with samples to be obtained in the well borings, standard well screen slot of 0.010-inch and silica sand gradations conforming to Morie No. 1 are anticipated.

A primary sand pack (Morie No. 1) consisting of clean silica sand will be placed around the well screen. The sand will be placed into the borehole at a uniform rate, in a manner that will allow even placement of the sand pack. The augers will be raised gradually during sand pack installation to avoid caving of the borehole wall; at no time will the augers be raised higher than the top of the sand pack during installation. During placement of the sand, the position of the top of the sand will be continuously sounded. The primary sand pack will be extended from the bottom of the borehole to a minimum height of 2 feet above the top of the well screen. A secondary, finer-grained, sand pack will be installed for a minimum of 1 foot above the coarse sand pack. Heights of the coarse and fine sand packs and bentonite seal may be modified in the field to account for the shallow water table and small saturated thickness of the surficial aquifer.

A bentonite pellet seal at least 2 feet thick will be placed above the sand pack. The pellets will be placed into the borehole in a manner that will prevent bridging. The position of the top of the bentonite seal will be verified using a weighted tape measure. If all or a portion of the bentonite seal is above the water table, clean water will be added to hydrate the bentonite. A hydration period of at least 30 minutes will be required following installation of the bentonite seal.

Above the bentonite seal, an annular seal of cement-bentonite grout will be placed. The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface through a tremie pipe. The tremie pipe must be plugged at the bottom and have small openings along the sides of the bottom 1-foot length of pipe. This will allow the grout to diffuse laterally into the borehole and not disturb the bentonite pellet seal.

For monitoring wells that will be completed above-grade, a locking steel protective casing set in a concrete pad will be installed. The steel protective casing will extend at least 3 feet into the ground and 2 feet above ground but

should not penetrate the bentonite seal. The concrete pad will be square or round, with a minimum radius of approximately 3.5 feet. The concrete will be sloped away from the protective casing.

Guard posts may be installed in high-traffic areas for additional protection. Four steel guard posts will be installed around the protective casing, within the edges of the concrete pad. Guard posts will be concrete-filled, at least 2 inches in diameter, and will extend at least 2 feet into the ground and 3 feet above the ground. The protective casing and guard posts will be painted with an epoxy paint to prevent rust.

For monitoring wells with flush-mount completions, Morrison 9-inch or 12-inch 519 manhole cover or equivalent, with a rubber-sealed cover and drain will be installed. The top of the manhole cover will be positioned approximately 1 inch above grade. A square concrete pad, approximately 3 feet per side, will be installed as a concrete collar surrounding the road box cover, and will slope uniformly downward to the adjacent grade. The road box and installation thereof will be of sufficient strength to withstand normal vehicular traffic.

Concrete pads installed at all wells will be a minimum of 6 inches below grade. The concrete pad will be 12-inches thick at the center and taper to 6-inch thick at the edge. The surface of the pad should slope away from the protective casing to prevent water from pooling around the casing. Protective casing, guard posts, and flush mounts will be installed into this concrete.

Each well will be properly labeled on the exterior of the locking cap or protective casing with a metal stamp indicating the permanent well number.

C. Well Development

Well development will be accomplished using a combination of surging throughout the well screen and pumping, until the physical and chemical parameters of the discharge water that are measured in the field have stabilized and the turbidity of the discharge water is substantially reduced. Fine-grained materials in the surficial aquifer at the site may not allow low turbidity results to be achieved.

The surging apparatus will include two surge blocks separated by approximately 2 feet of coarsely slotted pipe. The lower surge block will be solid; the upper surge block will be open and attached to riser pipe leading to the ground surface. Water will be pumped continuously from the surge block screened interval throughout the surging process. The pumping will be accomplished by airlift induction methods or using a centrifugal pump or equivalent.

Well development will begin by surging the well screen, starting at the bottom of the screen and proceeding upwards, throughout the screened zone.

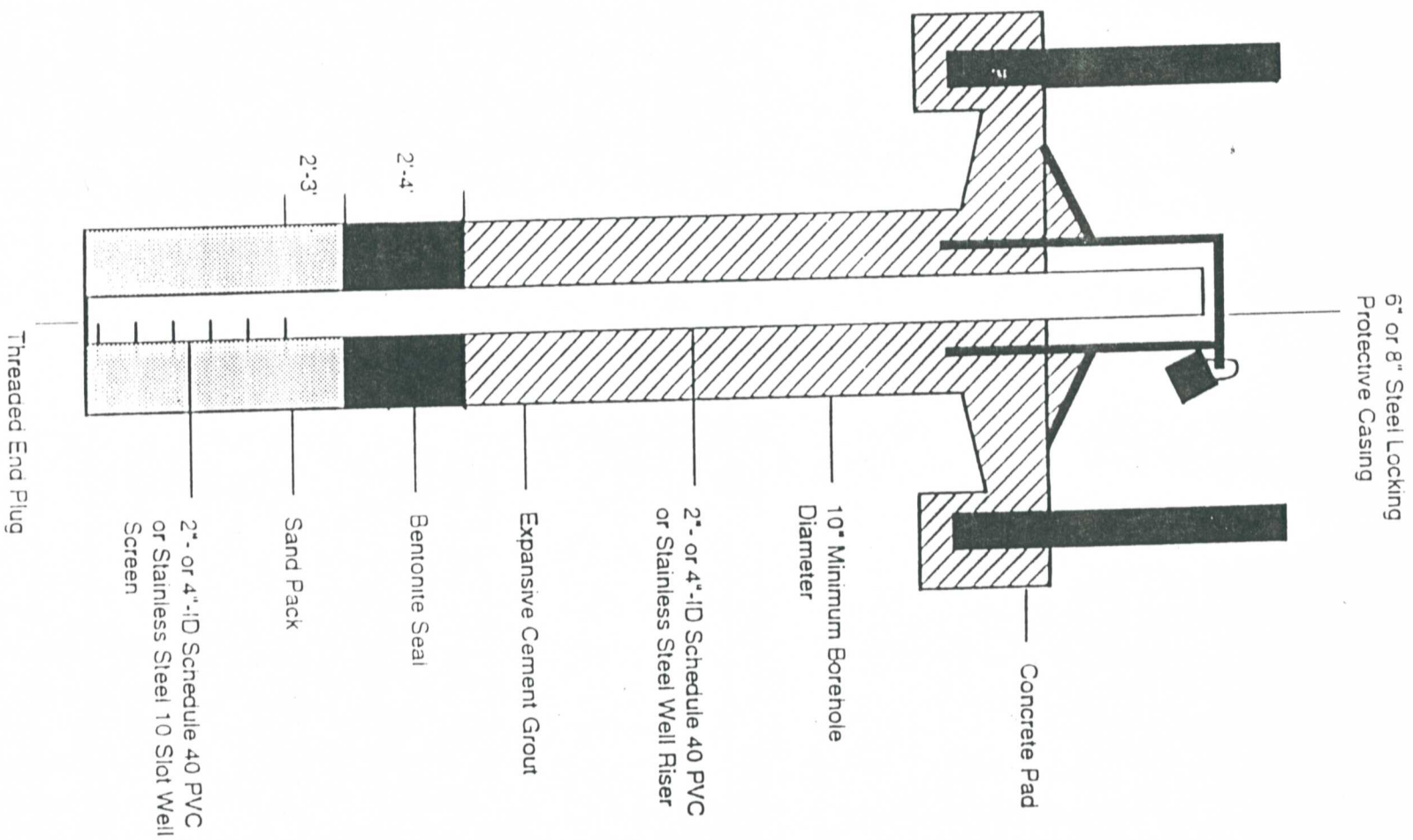
Following surging, the well will be pumped to remove the fine materials that have been drawn into the well. During pumping, measurements of pH, temperature, and specific conductance will be recorded.

Development will continue by alternately surging and pumping until the discharge water is free from sand and silt, the turbidity is substantially reduced, and the pH, temperature, and specific conductance have stabilized at regional background levels, based on historical data. Development will continue for a minimum of 30 minutes.

Well development equipment will be decontaminated prior to initial use and after the development of each well. Decontamination procedures are detailed in SOP Decontamination of Personnel and Equipment. Water generated during well development will be contained and managed as detailed in the Field Sampling Plan Investigation Denied Waste Management Plan.

IV. Attachments

Schematic diagram of shallow monitoring well construction



TYPICAL SHALLOW MONITORING WELL CONSTRUCTION